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ABSTRACT

Recent work in syntactic theory has revealed that word order is more constrained in subordinate clauses, particularly nonasserted clauses, than in main clauses (Ross, 1973; Hooper & Thompson, 1973). On the other hand, main clauses are restricted in the extent to which they allow pronominalization and verb phrase deletion (Lakoff, 1968). These formal properties of language may be due to a strategy the listener uses during sentence comprehension: interpret the asserted (main) clause as soon as possible. Two psycholinguistic studies which support the use of this comprehension strategy are reported. The first indicates that adult listeners have better access to the meaning of main clauses during sentence comprehension. The second study examines developmental changes in the listener's access to the nonsemantic, verbatim form of the clauses of temporal and coordinate sentences. The results indicate a general tendency across ages to interpret main clauses more quickly than subordinate clauses, with a shift at the four-year level to interpret initial clauses, regardless of structural type, more quickly than final clauses. The two studies together are consistent with the hypothesis that differences in the form of main and subordinate clauses are a product of comprehension strategies throughout development. (Author)

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Formal Differences in Main and Subordinate Clauses as a Product of Comprehension Strategies[1]

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I would like to describe some experiments that examine the mental processes that people use during language comprehension. These experiments generally show that people interpret main clauses more quickly than they interpret subordinate clauses. This conclusion has implications for linguistic theory in that certain differences in the form of main and subordinate clauses may be due to differences in the way people process the two types of clauses.

Ross (1973, 1974; see also Hopper & Thompson, 1973) has observed that word order varies less freely in subordinate clauses than in main clauses. He proposed that all languages possess the constraint that, when there are differences in the application of a reordering rule in main and subordinate clauses, the difference is always in the direction of greater restrictions on application of the rule in subordinate clauses. One example of this principle is shown in the first slide (Figure 1). Movement of an adverb to the front of main clause is acceptable, as in

(1) Tomorrow we will hire a new person even though we don't have the money to pay him.

but a similar process in a subordinate clause produces a sentence which is, at best, awkward, as in

(2) *Even though tomorrow we will hire a new person we don't have the money to pay him.

These examples suggest that word order is more constrained in subordinate clauses than in main clauses.

A second type of difference in the form of main and subordinate clauses is shown in the next slide (Figure 2). Lakoff (1968) has noted that verb phrase deletion is permissable in a sentence-initial subordinate clause as is

(3) If Max does Sally will buy a car.

but verb phrase deletion is unacceptable in a sentence-initial main clause as in

(4) *Sally will if Max buys a car.

On the other hand, verb phrase deletion is acceptable in both types of final clauses. Lakoff has also noted that there are constraints on co-referential pronouns: a sentence with an initial subordinate clause containing a pronoun that refers to a noun in the following main clause is acceptable, as in

(5) Before he left town John ate breakfast.

but a sentence with an initial main clause containing a pronoun that refers to a noun in the following subordinate clause is unacceptable, as in

(6) *He ate breakfast before John left town.

These constraints, however, are not found with pronouns that occur in final clauses.

Apart from these differences in form, main and subordinate clauses often differ in the types of information they convey. The main clause generally contains the assertion or more important information which the speaker wishes to convey. Subordinate clauses often convey presuppositional information which the speaker either places less importance on or assumes the listener already knows (Sellers, 1954). The speaker who utters

(5) Before he left town John ate breakfast.

appears to place more importance on the fact that "John ate breakfast" than

he does on the fact that "John left town."

These differences in the semantic function of main and subordinate clauses suggest that it may be beneficial for the listener, having a rather limited active memory, to focus his comprehension processes on the asserted, new information of a main clause and to postpone interpretation of the less important, old information of a presupposed subordinate clause. If the listener does interpret main clause information more quickly than subordinate clause information, he should have better access to the meaning of the main clause during sentence comprehension.

Experiment I

This prediction was tested in an experiment using 16 Montclair State College students as subjects. Each subject heard fragments of several sentences. The sentences were always interrupted just before the last word of one of the clauses. One-third second after hearing a fragment, the subject saw a slide which contained a verb-object phrase. The subject's task was to say as quickly as possible whether or not the phrase was consistent with the meaning of the sentence.

Some sample entence fragments are shown in the next slide (Figure 3). In another experiment which I will not describe here, subjects heard a single word after the blip as shown in this slide. But in the present experiment, the blip triggered a slide which showed a phrase like "covering a floor." This phrase, and the others used in the experiment, were produced by students in a psycholinguistics class under instructions to generate verb-object phrases which were consistent with the meaning of only one clause of the sentence. In the experiment, some subjects heard a fragment of the initial clause as shown in this slide, while other subjects heard the sentence with the interruption

near the end of the final clause as shown in the next slide. Trials in which the phrase was not consistent with the meaning of either clause were also included.

The results are shown in the next slide (Figure 5). The top part of the figure shows the average time for correct responses. The solid lines show recognition times for positive trials, that is, trials for which the phrase was consistent with the sentence. Subjects responded faster to phrases consistent with interrrupted main clauses than to phrases consistent with su subordinate clauses, F (1,8) = 12.3, $p < .01$. There was better access to the meaning of the main clause in both clause positions.

The dashed lines show the average times for negative trials, that is, trials for which the phrase was inconsistent with the sentence. For interrupted initial clauses, recognition times were faster for main clauses than for subordinate clauses, F (1,15) = 6.08, $p < .05$. For interrupted final clauses, however, the main/subordinate difference was not statistically significant, F (1,15) = 1.15, $p > .05$. Nevertheless, the results generally show that main clauses are interpreted more quickly than subordinate clauses.

Experiment II

In a second experiment we looked at the other side of the "comprehension coin," the listener's accessibility to the verbatim form of clauses. Previous experiments (e.g., Sachs, 1967) have shown that people retain the meaning but forget the actual verbatim form of sentences. Extending these results to the listener's representation of clauses just after hearning the sentence, we can make the following prediction. If people interpret main clauses more quickly than subordinate clauses, they should have poorer access to the verbatim form of main clauses.

In the second experiment we were also interested in how children develop strategies for processing two-clause sentences. Previous experiments (Amidon & Carey, 1972; Bever, 1970; Clark, 1971; Johnson, 1975; Townsend, 1974; Townsend & Erb, 1975) have suggested that children aged 3-5 years, like adults, may have better access to the meaning of main clauses. However, some of the previous experiments have shown a shift in comprehension strategies. In particular, some of Bever's (1970) work suggests that 3 year olds focus on the main clause whereas 4 year olds focus on the initial clause. We therefore expected children to generally have better access to the verbatim form of subordinate clauses, and we expected som type of shift between ages 3 and 4 in accessibility to the verbatim form of different clauses.

These predictions were tested in an experiment using 12 adult subjects and 12 subjects at each of the age levels 3, 4, and 5 years. As shown in the next slide (Figure 6), subjects heard complete two-clause sentences followed one second later by a single word, which they were to classify as being in the sentence or as not being in the sentence. The sentences contained temporal (i.e., adverbial) clauses, or relative clauses, or coordinate clauses. The sentences with coordinate clauses allowed us to examine differential accessibility to the verbatim form of initial versus final clauses that do not differ in structure Sentences with temporal or relative clauses, however, do contain clauses with different structure. These sentence types appeared in two forms, with the main clause in initial or in final sentence position. In each case, we assessed accessibility to verbatim form of both clauses by having the subject say whether or not either fed or hugged had appeared in the sentence.

The next slide (Figure 7) shows the results for accessibility to the verbatim form of main vs. subordinate clauses. Over both temporal and relative

sentences combined, the adults have better access to the verbatim form of subordinate clauses, $\underline{F}$ (1,44) = 8.78, $p<.01$. This result supports that assumption that relatively fast verbatim probe recognition indicates rather shallow comprehension, at least for adult listeners. The results also suggest that 4 and 5 year old children process sentences like adults, interpreting main clauses more quickly than subordinate clauses (4 yr.: $\underline{F}$ (1,44) = 123.4, $p<.001$; 5 yr.: $\underline{F}$ (1,44) = 198.0, $p<.001$). The 3 year olds, however, process sentences differently; they showed no difference on the two clauses of temporal sentences, and had better access to the verbatim form of main clauses in relative sentences.

The next slide (Figure 8) shows the results for accessibility to initial vs. final clauses. Overall sentence types the 4 year olds responded faster to verbatim probes of the initial clause, $\underline{F}$ (1,44) = 5.07, $p<.05$; all other age groups responded faster to probes of the final clause (3 yr.: $\underline{F}$ (1,44) = 10.83, $p<.01$; 5 yr.: $\underline{F}$ (1,44) = 14.5, $p<.001$; adults: $\underline{F}$ (1,44) = 5.07, $p<.05$). So, the data do support the hypothesis that there is a shift in comprehension strategies between ages 3 and 4 years.

It is unclear, however, whether the assumption that relatively slow word recognition times indicate deeper comprehension is valid for children. It is possible that younger children, who have more restricted processing capacity than adults (Huttenlocher & Burke, 1976; Chi, 1976), do not complete analysis of the clause they initially focus on. If this possibility is correct, the results might indicate that 3 year olds initially focus attention on main clauses while 4 year olds focus attention on initial clauses. Such a shift in comprehension strategy might be due to the 4 year olds' belief that the important information always appears first in the sentence, as

is often the case in English. Any firm conclusions about children's processing strategies must be highly tentative, however, until further work is done on the interpretation of children's word recognition performance.

How do the results of these experiments bear on the formal differences between main and subordinate clauses that were listed at the beginning of this paper? These differences may be due to the listener's attempt to interpret main clause information as soon as possible and to postpone interpretation of subordinate clause information until after the main clause has been interpreted.

It was noted that subordinate clause word order is more like the deep structure order than is main clause word order. Subordinate clause word order may be very similar to deep structure word order because words which occur in the deep structure order are easier to retain (e.g., Mehler, 1963). Main clause word order may not need to be as similar to deep structure word order because main clauses are interpreted as they are being heard and the words are not retained.

It was also noted that an initial main clause does not permit either a deleted verb phrase or a co-referential pronoun. The constraints on these properties in inital main clauses may exist because of the listener's attempt to interpret main clause information quickly. If verb phrase deletion and co-referential pronouns could occur in initial main clauses, the listener would be unable to interpret these clauses as he hears them. These properties are permissable in initial subordinate clauses, however, since the listener's strategy is to postpone interpretation of a subordinate clause until after the main clause has been interpreted.

The experiments, therefore, suggest that there may be a psychological basis for certain properties of language.

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Footnote

[1] Some of the data from Exp. II were presented in a paper, co-authored with T. G. Bever, read at the NATO Conference on the Psychology of Language, University of Stirling, Scotland and now distributed by the Indiana University Linguistics Club. Exp. II is described more fully in a paper, co-authored with D. Ottaviano and T. G. Bever, to appear in the Journal of Psycholinguistic Research. The research presented in this paper was supported by grants from the National Institute of Mental Health and from Montclair State College. The author wishes to thank Neal Fleischman and Jean Rouzic for their assistance with Exp. I.

Figure Captions

Figure 1. Effect of word order on grammaticality.

Figure 2. Effect of verb phrase deletion on grammaticality.

Figure 3. Procedure for Exp. I (A).

Figure 4. Procedure for Exp. I (B).

Figure 5. Recognition times for judging consistency of meaning in main and subordinate clauses.

Figure 6. Procedure for Exp. II.

Figure 7. Recognition times for verbs from main and subordinate clauses at different age levels. (Adapted from Townsend, Ottaviano, & Bever, Journal of Psycholinguistic Research, in press)

Figure 8. Recognition times for first and second clause verbs at different age levels. (Adapted from Townsend, Ottaviano, & Bever, in press)

EFFECT OF WORD ORDER ON GRAMMATICALITY

Movement of Adverb in Initial Main Clause

1) We will hire a new person tomorrow, even though we don't have the money to pay him.

2) Tomorrow we will hire a new person, even though we don't have the money to pay him.

Movement of Adverb in Initial Subordinate Clause

3) Even though we will hire a new person tomorrow, we don't have the money to pay him.

4) *Even though tomorrow we will hire a new person, we don't have the money to pay him.

EFFECT OF VERB PHRASE DELETION ON GRAMMATICALITY

Deletion in Final vs. Initial Main Clause

1) If Max buys a car, Sally will.

2) *Sally will, if Max buys a car.

Deletion in Final vs. Initial Subordinate Clause

3) Sally will buy a car, if Max does.

4) If Max does, Sally will buy a car.

EXPERIMENT I: PROCEDURE (A)

General Form: 90% of First Clause/blip/...Probe Word: {Early in Clause / Late in Clause}
1/3 sec

EXAMPLES

1) Main Clause First:

Early Target: Bob did put down some new tiles in the/blip/...DOWN

Late Target: Bob did put some new tiles down in the/blip/...DOWN

2) Subordinate Clause First:

Early Target: While Bob did put down some new tiles in the/blip/...DOWN

Late Target: While Bob did put some new tiles down in the/blip/...DOWN

EXPERIMENT I: PROCEDURE (B)

General Form:

First Clause, 90% of Second Clause/blip/...Probe Word: {Early in Clause / Late in Clause}
1/3 sec

EXAMPLES

1) Main Clause First:

Early Target: No work needed to be done in the apartment,
while Bob did put down some new tiles in the/blip/...DOWN

Late Target: No work needed to be done in the apartment,
while Bob did put some new tiles down in the/blip/...DOWN

2) Subordinate Clause First:

Early Target: While no work needed to be done in the apartment,
Bob did put down some new tiles in the/blip/...DOWN

Late Target: While no work needed to be done in the apartment,
Bob did put some new tiles down in the/blip/...DOWN

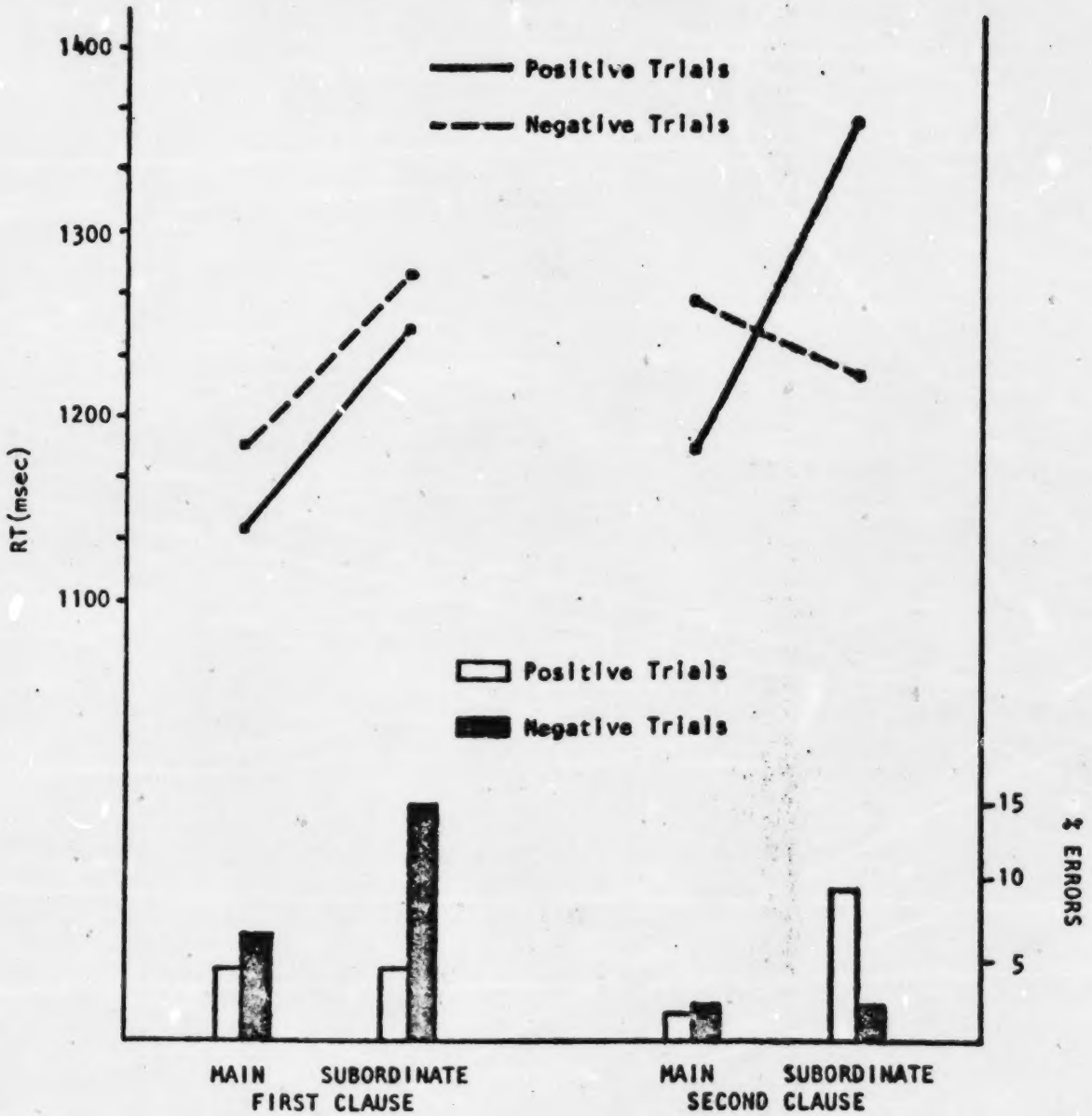

FIGURE 5. Recognition times for judging consistency of meaning in main and subordinate clauses.

EXPERIMENT II: PROCEDURE

General Form: First Clause, Second Clause.....Probe Word: {FIRST VERB / SECOND VERB}
1 sec

EXAMPLES

1) Coordinate Clauses:

The nurse fed the girl and she hugged the doctor..... {FED / HUGGED}

2) Main-Subordinate Clauses:

The nurse fed the girl after she hugged the doctor.... {FED / HUGGED}

3) Subordinate-Main Clauses:

After the nurse fed the girl she hugged the doctor.... {FED / HUGGED}

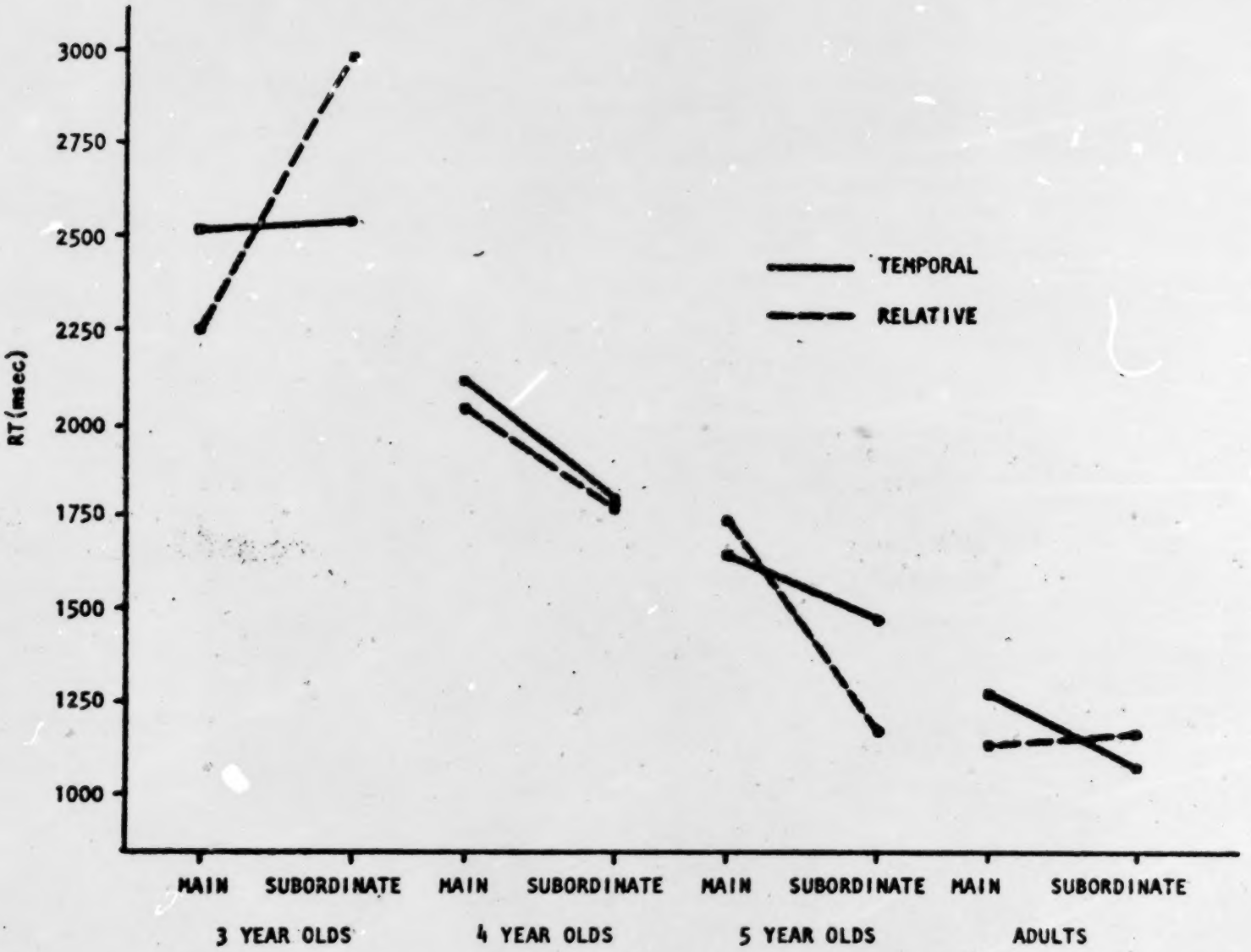

FIGURE 7. Recognition times for verbs from main and subordinate clauses at different age levels. (Adapted from Townsend, Ottaviano & Bever, in press)

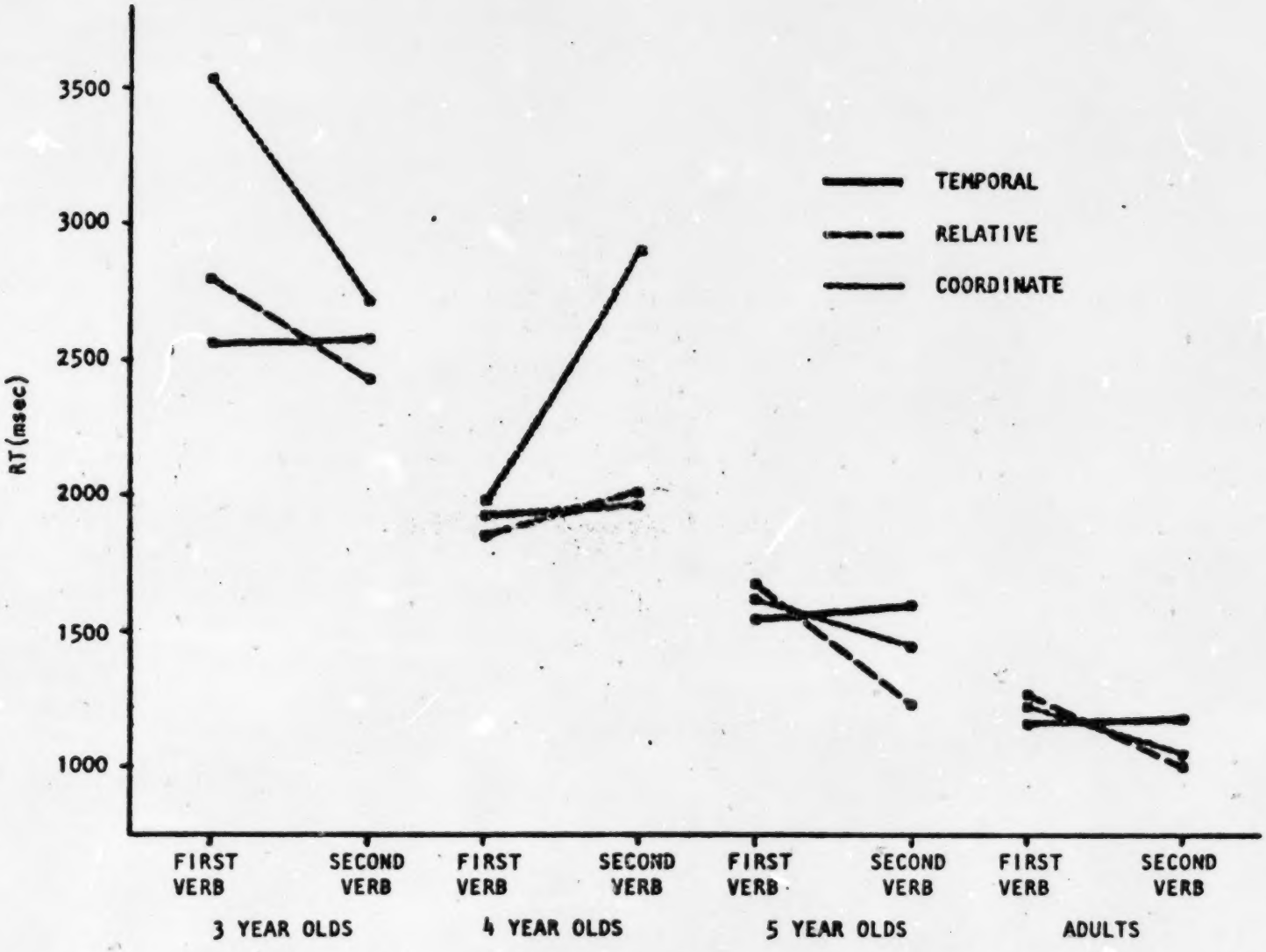

FIGURE 8. Recognition times for first and second clause verbs at different age levels. (Adapted from Townsend, Ottaviano, Bever, in press)